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THE LILY BEETLE, *CRIOCERIS LILII* SCOPOLI: ITS DISTRIBUTION IN BRITAIN (COLEOPTERA)

By G. Fox-Wilson, N.D.H., F.R.E.S.

The object of this note is to draw the attention of Coleopterists to the occurrence of this Criocerid in England, and to appeal to Fellows of the Society either to record or to notify the author of any outbreaks in any nursery or garden of which they are aware so that data on its distribution in the British Isles may be available to the authorities.

The misleading statements that appear in the literature concerning the host-plants of this beetle are due to the confusion between related species, namely *C. lilii* Scopoli (*merdigera* F.) and *C. merdigera* L. (Fox-Wilson (5)).

It is not the intention here to describe this species nor to outline its life-cycle, for such information is readily available (*loc. cit.*), but to confine remarks to its distribution in this country so far as the author is aware, and to give a list of its food-plants.

C. lilii occurs throughout Europe as far as Asia, and in North Africa (Balachowsky and Mesnil (1)), and sporadic attacks have occurred from time to time at widely separated districts in England over a period of years. It has now become established in certain districts in Surrey (*vide* map and Table 1). Fowler (4), apparently quoting Stephens (7), states that this species is very rare, but that it had been recorded from Deptford, Camberwell, Peckham, and one or two other London districts, and near Swansea. So far as is known from published records, the distribution in England is shown in the accompanying map (fig. 1).

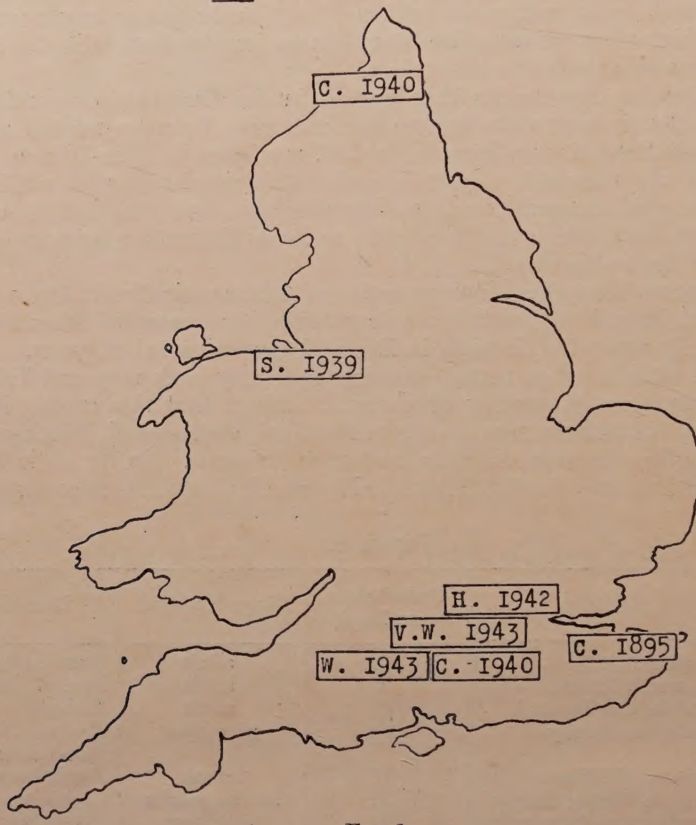
Table 1.

Date	District	Code Letter (see Map)	Stage recorded	Recorder
1895	Chattenden, Kent	C	adult	Turner (8)
1939	Sealands, Flints.	S	adult	Min. of Agric.
1940	Carlisle, Cumberland	C	adult	Richards (6)
	Chobham, Surrey	C	all stages	Barton (2) Fox-Wilson (5)
1942	Heston, Middlesex	H	larvae	Donisthorpe (3)
1943	Virginia Water, Surrey	V.W.	larvae, adults	this record
	Windlesham, Surrey	W	all stages	this record

Table 2.

Host-Plant	District	Date
Fritillaria Meleagris	Chobham, Surrey	1940
Lilium auratum var. *virginale*	Windlesham, Surrey	1943
L. candidum	Chobham	1941
L. giganteum	Chobham	1940
	Virginia Water, Surrey	1943
L. philippinense var. *formosanum*	Windlesham	1943
L. regale	Chobham	1940
	Virginia Water	1943
L. tigrinum	Chobham	1940
Nomocharis saluenensis	Windlesham	1943
Polygonatum multiflorum	Chobham	1940

The host-plants of *C. lilii* belong exclusively to the N.O. Liliaceae, and are given in Table 2. Records of this beetle attacking other Liliaceous plants, namely, Asparagus, Onion, Garlic, Chives and Smilax, are due to confusion between closely related species of *Crioceris* (5).



Recorded localities of Crioceris lilii Scop. in England.
(see text for code letters).

FIG. 1.

The author desires to express his sincere thanks to Dr. K. G. Blair for information concerning this species, and to Mr. H. M. Edelsten for providing data on the 1939 outbreak in Lancashire.

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A SWARM OF LADYBIRDS (COLEOPTERA) ON THE LIBYAN DESERT COAST OF EGYPT BETWEEN HAMMAM AND ABUSIR

By Prof. F. W. Oliver, F.R.S.

[Communicated by Dr. O. W. Richards.]

The swarm was observed forming a pure Ladybird drift line on the morning of 26th April, 1939. The species has been identified by Dr. K. G. Blair of the British Museum (Natural History) as *Coccinella 11-punctata* L.

The drift line when first observed at 11 a.m. was a few feet from the edge of the sea at a point opposite Hammam. Thence I traced it east to Abusir (opposite Burg-el-Arab) and a farther two miles to a point opposite Kom el Nugus, making a length of thirteen miles. It may have continued in both directions indefinitely, but the length of thirteen miles is all that can be guaranteed. Roughly, Burg-el-Arab is half-way between Alexandria and Alamein. The line was about six inches high and eighteen inches wide. I estimated (conservatively) the number of ladybirds at about 70,000 to the foot run, which means 350 millions per mile, and about 4500 millions for the entire distance of thirteen miles.

A fair proportion of these beetles still showed signs of life; from this and the general nature of the circumstances, it is reasonable to assume that they had come ashore earlier in the day. Even when I was there a thin scattering of ladybirds was still coming ashore floating on the water: these for the most part were still alive, but unlikely to recover.

The conclusion drawn was that a vast swarm of these insects had been overtaken by disaster off-shore and brought down to sea level before they could land, and had then drifted in with the tide. Being unfamiliar with the habits of these insects, I do not attempt to reconstruct the nature of the accident —which after all may have been just an error of judgment on their part, and not a physical catastrophe. The weather during the preceding twenty-four hours had been fine, with winds of moderate velocity from the north-west. Nor can I offer any suggestion as to the source of these ladybirds—*i.e.* whether it was from Europe they came, or whether after all they may not have drifted out from the African shore. Whilst I was able to verify a ladybird drift thirteen miles long, this may be only a small fraction of the entire phenomenon.

The desert spring, which in Libya culminates in March, had been in 1939 an indifferent one, and I incline to the belief that the nutrition on which a migration of this magnitude was based must have been provided on the European side. Our prevailing wind comes from the north-west and quantities of things, obviously from Europe, reach our shore. Notable in this respect are *Posidonia* balls, compacted of the macerated fibres of the leaves of the submerged marine phanerogam *Posidonia oceanica* (Potamogetonaceae). These drift ashore in such vast quantities that they might be exploited as a raw material for paper making. They range in size from half an inch to about 6 inches, with average dimensions about mid-way between these. This plant is recorded as growing on the shore to the east of Alexandria, but I have never found it *in situ*, and anyway even should it occur there, it could never reach the sector west of Alexandria, as the inshore current is from west to east. Then we find bits of pumice stone and occasional gnarled butts of trunks of *Acer campestri*—doubtless from Europe.

Several records of the arrival of large swarms of ladybirds in Egypt have been made (see 1926, *Bull. Soc. roy. ent. Egypte* **10** : 255–256), the dates being 6th April, 1926, March 1913, and July 1926. The last on the coast near Aboukir, N.E. of Alexandria.

A TWO-HORNED LARVA OF *MIMAS TILIAE* L. (LEPIDOPTERA)

By E. A. Cockayne, M.A., D.M., F.R.C.P., F.R.E.S.

On July 31, 1942, I received from Mr. G. H. Marillier a full-grown larva of *Mimas tiliae* bred by a schoolboy from eggs supplied by Mr. L. H. Newman. This was exhibited, as a blown specimen, at the Society's meeting on October 6th. The normal horn on the 8th abdominal somite is unusually small, blue above and red below, but the additional horn on the 9th abdominal somite is twice as long, strongly curved, and red in colour with a narrow blue dorsal line. It resembles the two-horned larvae of *Laothoë populi* L. and *Sphinx ligustri* L. described and figured by Mr. C. N. Hawkins and myself (1933, *Trans. R. ent. Soc. Lond.* **81** : 27).

The horns of Sphingid larvae are developed either from the tubercles of the anterior trapezoidal setae or from their bases, which become fused and greatly elongated. The condition is an interesting example of homoeosis, the 9th abdominal somite having some of the characters of the 8th.

We proved that the condition is recessive in *Sphinx ligustri*, but in our table on page 30 the figures for brood D (1932) are transposed; the pairing between two heterozygotes produced 60 normal and 18 two-horned larvae, the expectation being a ratio of 58·5 to 19·5. It is probable that it is recessive in *M. tiliae.* The stock originating in Bexley has been inbred for several years, and there may have been others, which escaped notice, for large numbers are bred in sleeves and no careful observation of the larvae is made, and many others are sold as eggs. Mr. R. L. E. Ford informs me that the late Baron Bouck had a two-horned larva of *Hyloicus pinastri*, the second horn being on the 9th abdominal somite. The condition is therefore known to occur in four species belonging to four different genera. One wonders whether it is a very ancient mutation, which occurred in the common ancestor of these Sphingids or, whether, as is more probable, the same mutation occurred on four separate occasions in the four species. In any case it is likely to be found in others.

A very different arrangement is recorded and figured by A. Kittelmann (1936, *Ent. Zeitschr.* **50** : 143) in *Sphinx ligustri.* He gives the following account of it. This larva was one of fifty bred from eggs from a wild pairing found in 1935 in Breslau. At the third moult it had little prominences on the 4th, 5th, 6th, and 7th abdominal somites. They were 1 mm. in height, shining and black, with a horny surface. On each somite one stood on each side close to the midline. At each moult they became closer together and in the last instar were nearly fused. If this had gone on fusion would have taken place, and the larva would have had five horns instead of nine. No doubt the horns had been present from the time of hatching. The pupa was quite normal.

As in the two-horned larvae these extra horns appear to be modifications of the anterior trapezoidal tubercles and setae, but the four somites immediately in front of the 8th abdominal show homoeosis instead of the somite immediately behind it.

ON COLLECTING AND REARING PARASITIC HYMENOPTERA WITH SPECIAL REFERENCE TO THE GENUS *APANTELES* (HYM. BRACONIDAE)

By R. L. E. Ford.

The late D. S. Wilkinson intended to publish most of the following notes in his Monograph of the Palearctic *Apanteles*, but his unfortunate death while this work was still incomplete will so delay final publication that, in response to many requests, I am now making the following information available for other workers in the same field.

Since species of *Apanteles* are exclusively parasitic on Lepidoptera it is obvious that the first essential for their successful collection is a very thorough working knowledge of methods of collecting lepidopterous larvae in the field, and of rearing them to maturity.

There are two methods of obtaining parasitic Hymenoptera, (1) by sweeping or catching, (2) by breeding from the host larvae.

Sweeping.

Sweeping is more satisfactory when as large a variety of species as possible is required. Some species can at first be obtained only by this method, since there are some species of lepidopterous larvae which cannot be collected and reared, though their parasites may be found by sweeping. The disadvantages of sweeping lie in the condition of the specimens obtained and the lack of any biological information upon which to base an opinion as to the economic importance or otherwise of the insects discovered. However, any collector who has carried out sweeping for parasites on a large scale will agree that there is much to learn in this field. Briefly, I find the best method of sweeping to be as follows. Use a large kite net with a pointed tiffany bag, then after making a sweep close the hand round the lower portion of the bag, where the catch is congregated, and dip this in a tin containing chloroform on cotton wool. After about one minute the contents can be turned out for sorting on a white card tray, the tray having sides high enough to provide slight protection from any wind. The specimens to be kept should be sucked into a large clean tube by the usual apparatus and allowed to recover. This is very important, since they will then clean themselves from pollen and lepidopterous scales collected while in a mass at the bottom of the net. Most specimens seem to be in a better condition for subsequent examination if allowed to die naturally in the tube instead of being deliberately killed.

When biological information is required concerning some particular species it is desirable that three or more persons should sweep over the same area. Analysis of the contents of their bags will always show that each person catches a fauna distinct from the others, although, of course, there is a good deal of overlapping. This is due to the differences in individual collecting. One collector may have a longer reach than others, another may sweep the tops of herbage only, and another will brush harder and nearer the ground. Most collectors will reach out to include the tops of certain flowers which subconsciously attract them, and these may later prove to be those favoured by the insect being hunted.

Much can be learned from observation while working on these lines, and very accurate data of swept specimens should therefore be kept. Since Hymenoptera are in one area or on one plant for a specific purpose, either just emerging, searching for the correct host larvae, or merely feeding from a favourite blossom, the plant or type of vegetation from which specimens are obtained should always be recorded.

It will be noticed that far more male than female parasitic Hymenoptera are obtained when sweeping, but if sweeping is combined with even a slight knowledge of the breeding habits of a particular species, different results can be expected. For instance, I discovered that *Apanteles lateralis* Hal. has several broods a year on the larvae of the Nettle Tap, *Simaethis fabriciana* Linn. The *Apanteles* pair immediately after emergence, and if nettle beds are swept at the time the host larvae are emerging from the eggs female *Apanteles* only are obtained, since these will be waiting to oviposit in the larvae. The males of this *Apanteles* will be swept some distance away amongst the blossoms. This example also illustrates the importance of recording, *e.g.*, " swept from nettles," especially if the species obtained in this manner is unknown to the collector at the time. (Wilkinson 1939.)

BREEDING FROM WILD COLLECTED HOST LARVAE.

Before describing methods of breeding there are a few general factors to be considered. Hymenopterous parasites can be obtained in very large numbers by collecting host larvae and rearing them to maturity or until the parasites emerge. Host larvae should be collected from very widely distributed areas, from as many different areas as possible, and in very great numbers. Exactly the same procedure should be carried out over a number of years. If a failure occurs at the first attempt to obtain a parasite from a specific host this is often due to the percentage of parasitism being low in that year. The parasite may occur in hundreds over the same area in the following year.

The quantity of host larvae to be collected appears to be of the greatest importance. In many instances I obtained series of about twenty *Apanteles* of various species from different hosts. When repeating this a year later to obtain confirmatory evidence of the host records and dates, on a much larger scale, I obtained a series of about two hundred individuals of the various species. On examination, series of this length, all bred from the same host, proved to contain not one species of *Apanteles*, but often a second or third, the number of each species varying from year to year. Having discovered this, I again collected host larvae for species of *Apanteles* of which I had previously obtained short series, only this time on a larger scale, and found in most cases at least a second species of *Apanteles* could be obtained from the same host, specific to that host. Early writers working on short series have more than once described males of one species and females of another under one name, both being bred from the same host. The occurrence of more than one species of *Apanteles* on one host is chiefly confined to the micro-lepidoptera and would also appear to occur amongst other parasitic Hymenoptera; but much of the material obtained at the same time remains to be examined.

Where lepidopterous larvae of one species occur in a variety of situations a number should be collected from each situation. I collected more than two thousand rolled leaves of maple containing the larvae of *Gracilaria semifascia* Haw. for three years in succession. I picked those within easy reach and obtained an average of five examples of *Apanteles laetus* Marsh. each year.

The fourth year I collected a similar quantity of rolled leaves from not less than twenty to thirty feet from the ground, in addition to those within easy reach, which were kept apart. The leaves from the tree-tops produced over one hundred examples of the same *Apanteles*.

It is also advisable to collect sufficient host larvae to provide a fairly long series of any adult parasite being sought after, since, besides the advantage of a long series for descriptive work, allowance should be made for loss by the appearance of hyperparasites, which are often numerous, and also to ensure that a fair proportion of each sex is obtained. In long series of solitary *Apanteles* the sexes are about equal in number, but in gregarious species the males are more numerous.

The following figures of sex ratios are taken from series of *Apanteles* bred from wild collected larvae.

	Males	Females
Apanteles coleophorae Wilkinson	26	21
Apanteles phaloniae Wilkinson	18	14
Apanteles phaloniae Wilkinson	25	43
Apanteles gracilariae Wilkinson	7	8
Apanteles gracilariae Wilkinson	12	11
Apanteles carbonarius Wesmael	22	23
Apanteles comes Wilkinson	11	4
Apanteles praepotens Haliday	72	80
Apanteles circumscriptus Nees	27	19
Apanteles circumscriptus Nees *Apanteles circumscriptus* Nees	7	9
Apanteles princeps Wilkinson	22	27
Apanteles maritimus Wilkinson	12	8
Apanteles maritimus Wilkinson	15	13
Apanteles maritimus Wilkinson	20	23
Apanteles britannicus Wilkinson	14	19
Apanteles britannicus Wilkinson	40	33
Apanteles imperator Wilkinson	13	23
Apanteles victor Wilkinson	813	794
total	1176	1172

This agrees favourably with the figures given by Richards (1940) for *A. rubecula* Marshall, all the species being solitary parasites.

The chief difficulty to be met with in rearing large numbers of lepidopterous larvae is that of keeping the larvae under suitable conditions. The actual collecting, once the host required has been located, is often a matter of repetition and perseverance until a sufficient number have been obtained.

The majority of macro- and a few of the micro-lepidoptera larvae are best sleeved on the growing tree or food-plant. Many hundreds can be kept in one sleeve but the chief disadvantage of this method is that the entire contents of each sleeve must be examined once every eight days. This is about the shortest period in which I find a host larva can produce a parasite which would pupate and emerge before the sleeve was re-examined. Parasite pupae should be removed as they appear and kept as described later on.

After a little experience it is possible to judge the number of larvae to place in a sleeve so that by the end of eight days most of the leaves have been devoured, thus making the task of searching for parasites much easier, but the debris at the bottom of the sleeve must be searched also, since host larvae will eat round a parasitic cocoon on a leaf, causing the cocoon to drop off on a small piece of leaf which might be overlooked. If too many larvae are in one sleeve, not only will they suffer from the effects of starvation, for Geometrid larvae will readily eat *Apanteles* cocoons, but not the pre-pupa within, which shrivels up.

It is obviously necessary to examine the food-plant before sleeving in case there are wild larvae or spiders already on the leaves. This is often overlooked, even when placing fresh food in cages, and is no doubt responsible for some of the strange and obviously incorrect host records to be found in literature. The host larvae which reach the pupa stage can be treated according to the special requirements of each species, and pupae can be removed to an emergence box. Over-wintering pupae are best stored in clean airtight tins, in a cold but dry situation, and placed in an emergence box in the early spring, when frequent dampening will be necessary to assist the emergence of both hosts and parasites. It is a mistake, often made, to expose pupae in sunlight to encourage emergence.

Various methods of keeping micro-lepidopterous larvae have already been described (Ford, L. T., 1940). Some of these methods can be adopted on a large scale and many hundreds of larvae can be reared in a comparatively small space. When rearing very large numbers of micro larvae it is best to devise some special form of cage or container best suited for the species from which parasites are desired, and to scrap this when finished with, accordingly inexpensive but practical apparatus is desirable.

Apanteles laetus Marsh., mentioned earlier, was bred from its cocoons, which are formed in rolled " cones " on maple leaves. The leaves forming cones were collected when the host larvae were in their last instar. For this species I used a number of round earthenware seed-pans, about one foot in diameter and from four to five inches in depth. The rims of the pans were first ground flat by inverting the pans on a flat, wet, stone slab and rotating them. When covered with a sheet of plate glass this made an almost airtight joint. I placed about an inch of sterilised sand in the bottom of each pan and sufficient leaves to cover this over. The chief advantage of this type of apparatus is the easy regulation of the moisture content in the pans. The pans are, of course, kept in the shade. If beads of moisture collect on the underside of the glass the sheet can be reversed, and with freshly gathered leaves it is best to turn the sheets morning and evening. As the leaves become drier, however, water should be added by sprinkling. There should be a pause between the pupation of the host larvae and the emergence of parasites, and once emergences commence the moisture should be increased.

When parasites have emerged they walk about the underside of the glass. For catching these, from this and other types of apparatus, without loss, it is safest to use a special window made from a large plywood tea-chest with the bottom replaced by glass, and placed on one side, glazed end towards the strongest light. The pans or cages, etc., can be placed in this one at a time and the flies liberated, when they will fly towards the light and can be collected from the glass at the end of the tea-chest with a suction tube.

Collection, pupation and emergence dates should be recorded for all bred parasitica, otherwise full life-cycles cannot be determined. There is very little material available at present with such data.

Many species of both macro- and micro-lepidoptera can be reared on their food-plants grown in tubs, half-barrels, or large flower-pots. A sleeve can be tied round the rim of the tub and the top end of the sleeve to a cane stuck in the earth in the tub. This is most suitable for hibernating species. When using this method the greatest care should be taken to ensure that no slugs or other predators are housed with the plants and larvae.

Wood-lice, which I find readily attack Lepidoptera in all stages, often collect round the edges of wooden tubs and outdoor cages. They can be controlled by a mixture of dried blood and Paris green, about a teaspoonful of which should be placed on the earth in each tub.

A simple method of dealing with huge quantities of larvae feeding in or on blossoms or stems of plants such as Yarrow, Golden-rod, Sea Lavender, etc., is to place the stems upright in a large-sized tea-chest with a few inches of clean sand on the floor. The top should be kept insect-tight and dark, which can be done effectively by a square of felt weighted on top. A glass jam-jar, with the base removed by a red-hot poker, should be inserted base first through a hole in the side of the plywood chest, near the top. The top of the jam-jar, left protruding, can be covered by muslin and an elastic band.

At first many spiders and various insects will appear, and when these are removed care should be taken to see that the base of the jam-jar tube has not been webbed over. All flies emerging, both Diptera and Hymenoptera, will collect in the jar, having flown towards the light, and the jar can be pointed into the emergence window just described and the muslin removed. I bred *Apanteles phaloniae*, Wilkinson (1940), and *Apanteles princeps*, Wilkinson (1941A) by this method and also *Apanteles victor* and *Apanteles britannicus*, Wilkinson (1941B).

The host of *Apanteles victor* is the Tineid, *Goniodoma limoniella* Staint., which feed on the blossoms of Sea Lavender. The larvae, which appear in August, house themselves in a floret after the manner of a *Coleophora* and when fully grown in September descend and bore into the stem of the food-plant, leaving the floret outside. The larvae remain dormant until they pupate in July the following year. To obtain the *Apanteles* I collected a very large quantity of stems indiscriminately, at the end of August, and stored them by the tea-chest method out of doors but under cover. About the end of July the following year these were taken indoors and half a pint of water sprinkled over the tops of the stems in each chest every day. Under natural conditions these stems stand in salt water at high tide and are completely covered by spring tides.

So wet did the tops of the stems in the cages become, that the seeds all sprouted and resembled a layer of mustard and cress. The peak emergence period for the *Apanteles* was reached at the middle of August and altogether over two thousand individuals were reared, the parasite being a solitary species. The most remarkable feature of this experiment was the entire lack of mould at all stages although the green fur seaweed on the stems developed on the sand on the floor of the tea-chests. The lack of mould may have been due to the presence of sea salt on the stems but I have not yet had the time to test saline solutions for keeping down mould on other plant material.

Mould is by far the most difficult thing to overcome when breeding Lepidoptera, especially micro larvae feeding in blossoms. *Apanteles* cocoons will, however, resist a considerable amount of mould without ill effect. To breed *Apanteles annularis* Hal. from the host *Cnephasia incertana* Treits. I gathered a considerable number of *Ranunculus* blossoms with a larva present in each. These blossoms were picked off close to the head and placed in a layer in large tins covered with muslin. The sides of the tins were surrounded by small strips of corrugated paper. In spite of the muslin tops of the tins allowing the blossoms to become dry fairly rapidly, mould commenced to form at once, but a few fresh blossoms were added each day, into which the larvae crawled. The fully grown larvae crawled into the tubes formed by the corrugated paper, where ultimately parasitic cocoons were also formed. The paper strips were removed to a clean emergence cage and moisture added. Besides obtaining a long series of *Apanteles* I had a series of Microgasters and *Chelonus* and much other material not yet identified.

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AN OCCURRENCE OF *NASUTITERMES COSTALIS* HOLMGREN IN ENGLAND (ISOPTERA)

By N. D. Riley.

The number of recorded instances of the introduction of termites into England is remarkably few. McLachlan exhibited a species of *Calotermes*, allied to *C. solidus* Hagen but thought to be undescribed, at the meeting of the Society held on 1 June, 1874, and referred to it more fully in a note in 1874, *Ent. mon. Mag.* **11** : 15, pointing out that the names applied to it—*Eutermes lateralis* Walker, in the *Proc. Linn. Soc.*, 7 May, 1874, and *E. nemoralis* in *Nature*, No. 238 : 57—were both erroneous. The species had arrived at Kew in the trunk of an E. African tree, *Trachylobium Hornimanniana*.

That termites could be reared in England was shown to be possible from the experiments of G. D. Haviland and Dr. David Sharp, referred to in the *Proceedings* of the Society on 5 June, 1895, and dealt with much more fully in the *Transactions* of the following year (p. 589 *et seq.*). These experiments were carried out with the Malayan species *Calotermes artocarpi* Hav. A less successful attempt to maintain a colony of termites was made at the Zoological Gardens, Regent's Park, more recently. Mr. W. Frost brought home, as food for birds during their transport from India, several small subterranean nests of *Eutermes*, one of which was still intact on arrival. This was received early in 1934, but by May the entire colony had died out. Possibly other instances of the occurrence of termites in England have been recorded; a thorough search of the literature has not been attempted.

In June, 1942, the Department of Entomology of the British Museum (Natural History) received from Mr. Luker a few specimens of a species which had appeared in the cellar of a public house at Spalding in Lincolnshire. Examination by Mr. F. Laing showed that it was *Nasutitermes costalis* (Holmgren), which may or may not be a synonym of the much older *morio* Latreille. This species occurs throughout the West Indies, Central America and the northern countries of S. America. Enquiry elicited the information that the termites had been found "in a kind of nest in packing which came from Martinique" and had been discovered a few days after the arrival of the package, but the proprietor of the inn, being unaware of the interest attached to them, had destroyed the insects. The total number of specimens found, it was stated, "would all have gone into a small mustard pot". The occurrence of the species in Martinique had been recorded quite a number of years ago.

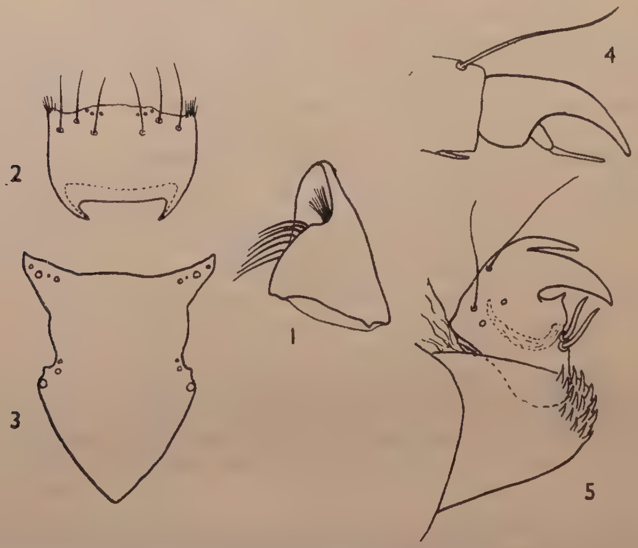
Specimens were exhibited at the Society's meeting on 3rd March, 1943. I am greatly indebted to Mr. Laing, not only for identifying the termites from Spalding for me, but also for supplying me with references to the records of previous occurrences of termites in England.

A NOTE ON THE CADDIS FLY, *MYSTROPHORA INTERMEDIA* KLAPALEK (TRICHOPTERA)

By D. E. Kimmins.

Dept. of Entomology, British Museum (Nat. Hist.).

This insect, belonging to the family Rhyacophilidae, was first recorded as British by Morton (1925), from a stream on the borders of Coniston Water. No subsequent records of its occurrence, either at this locality or elsewhere in the British Isles, have come to my notice, and in consequence my colleague, Mr. W. E. China, and I determined to ascertain whether the species still occurred at Coniston. On 16 April, 1942, we paid a visit to Coniston Water, and worked southwards along the western shore of the lake from Coniston Hall, examining the various streams. From Morton's description of the locality we were able to recognise the stream (marked on the six-inch ordnance survey as Hoathwaite Beck) but no adult Trichoptera were found. It contained numerous stone cases of the *Agapetus* and *Glossosoma* type, and in a sample brought back to the laboratory for more detailed examination, one male pupa was found, showing the characteristic claw-like spur of the hind tibia and male genitalia. A second visit on 24 April produced more pupal material and one case containing a dead larva. Two further visits were made, on 1st and 5th of May, when a number of adults were taken. These were mostly captured in flight, beating accounting for very few examples. The dull colouring of the adults makes them very inconspicuous in flight, which is rapid and rather erratic, within an inch or two of the surface of the water. This latter habit adds considerably to the difficulties of netting them.

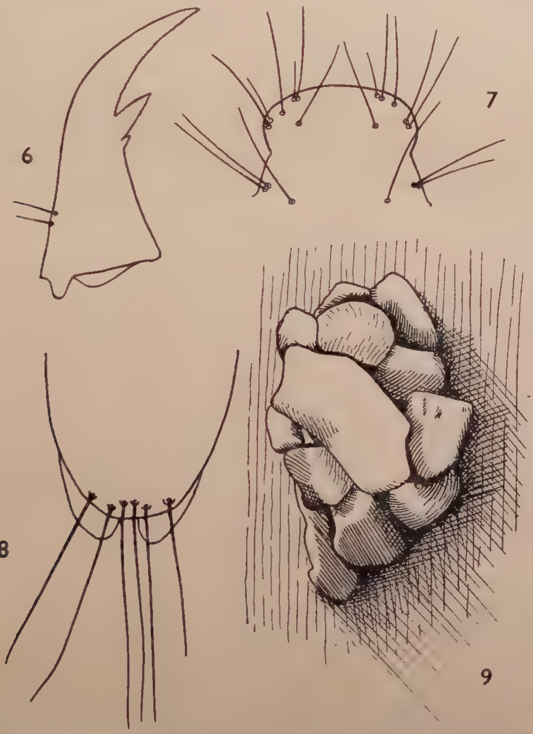


Figs. 1–5.—*Mystrophora intermedia* Klap., larva. 1, mandible; 2, labrum; 3, clypeus; 4, tarsal claw; 5, terminal abdominal hook.

PROC. R. ENT. SOC. LOND. (A) 18. PTS. 10–12. (DECEMBER 1943.)

The part of Hoathwaite Beck on which *Mystrophora* occurs is rather flat and runs through pasture land, with scattered trees, bushes and clumps of rushes on its margins. A little farther upstream there is a small wood in which a number of the specimens were taken. The bottom of the stream is composed of small and medium-sized stones, with silt in the quieter portions.

According to Lestage (1921), the larva and pupa of *Mystrophora intermedia* are unknown, and I have not been able to trace any subsequent reference to these stages. I have therefore prepared the following notes and figures from the rather limited material at my disposal. The larval description is based on one specimen which had failed to pupate, and on fragments of larval exuviae in other pupal cells.

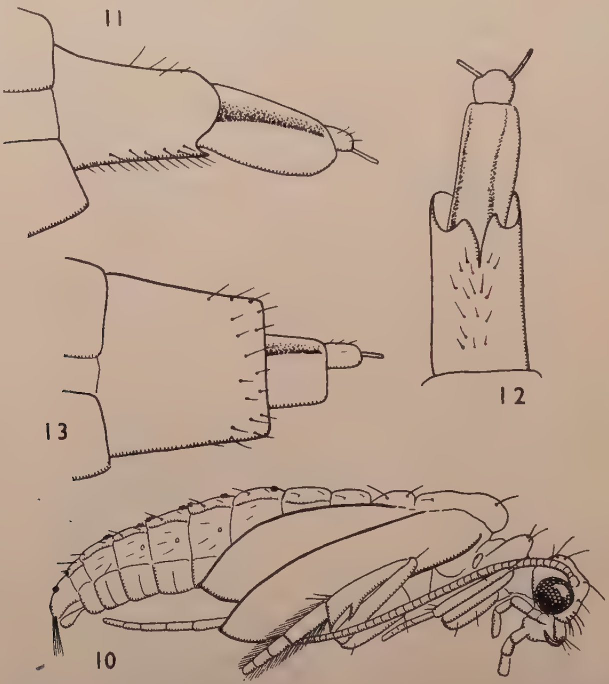


Figs. 6–9.—*Mystrophora intermedia* Klap., pupa. 6, mandible; 7, labrum; 8, apex of abdomen, dorsal, female; 9, stone pupation case.

Larva: closely resembling that of *Glossosoma*. In comparison with the figures given by Lestage (1921), the mandibles (fig. 1) are broader at the base and more triangular than those of *Glossosoma boltoni*. The labrum and clypeus are also similar (figs. 2–3), but Lestage does not figure the bristles or their sockets on the latter. The tarsal claw and the terminal abdominal hook (figs. 4–5) are of the *Glossosoma* pattern. On the apical segments of the latter are two stout setae which are not figured by Lestage.

The characters given by Lestage for the pupa of *Glossosoma* are insufficient to separate *Glossosoma* and *Mystrophora*. In the male pupa of the latter, the specialised spur of the hind tibia and the genitalia are unmistakable. There are the same number of toothed plaques on the abdominal tergites. In the male, the teeth are more numerous than in *G. boltoni*, the post-segmental plaques of IV and V are larger, as is also that on IX. The arrangement of the bristles on the segments appears to be identical.

The inner pupal cell is reddish-brown, warmer in colour than in *G. boltoni*. The stone case (fig. 9) is similar in size and structure to that of *G. boltoni*.



FIGS. 10–13.—*Mystrophora intermedia* Klap. (10–12) and *Glossosoma boltoni* Curt. (fig. 13). 10, pupa; 11, apex of abdomen, adult female, from side; 12, the same from beneath; 13, *Glossosoma boltoni* Curt., apex of abdomen, female, from side.

In the adult female (figs. 11–12), the eighth abdominal segment is more slender and more tapered than in *Glossosoma*, its apical margin from the side roundly produced, with a rounded excision in the lower half. From beneath, there is a deep median excision with slightly convex sides, and on each side of it can be seen the lateral excisions already mentioned. From above, the apical margin is widely and shallowly excised. In *Glossosoma* the apical margin of the eighth segment is truncate (fig. 13).

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A CASE OF PROGRESSIVE EVOLUTION IN COLEOPTERA WHICH, IF UNCONTROLLED, WOULD LEAD TO EXTINCTION

By Dr. K. Jordan, F.R.S.

Before the publication of Straus-Durckheim's classical work on the morphology of Coleoptera (1828), Stein's monograph on the abdomen and sexual organs of the female beetles, and Erichson's Insects of Germany (1848 & ff.) very little attention had been paid to the segmentation of the venter of Coleoptera. The researches of these authors so greatly advanced the knowledge of the exposed beetle abdomen that not much of fundamental value has been added since. The term abdomen as here employed excludes the posterior segments modified for the purposes of reproduction. In giving a short survey of the known stages in the ventral abdominal segmentation of a few families, I do so with the object of having a basis for some suggestions concerning the trend of evolution in the beetle abdomen and the disastrous effect the trend, if uncontrolled and carried to the extreme, would have on the life of the species.

It was discovered in the first half of the nineteenth century (1) that in some families of beetles all abdominal sterna are connected with one another by intersegmental membranes, the sterna being *free* and telescoping; and (2) that in other families two or more sterna are firmly soldered together, such sterna being *connate*.

The number of connate sterna having been found constant in some families, Erichson and others after him made use of this distinction in their classifications of the Coleoptera. But the discovery did not meet with enthusiasm by all coleopterists, and I quite sympathise with Lacordaire in his complaint (1854, *Gen. Coléopt.* **50** : xix) that " it is often very difficult, not to say impossible," to verify connation in dead beetles. As even in the most firmly connate venter the division into segments remains indicated on the outer surface by transverse channels and on the inner usually by ridges, and as the channels sometimes are deeper between the connate sterna than between the free ones of the same venter, very thorough maceration is necessary for ascertaining whether the segments are free or connate. This difficulty accounts for uncertainties, contradictions and errors in the literature on Coleoptera.

The following diagrams of the lateral aspect of some abdomina are sketched from relaxed and dissected specimens. They are drawn the same length in order to facilitate comparison. The terga are indicated by thinner lines. Below each figure there is a sketch of the longitudinal median section of the venter. The sternum of segment I is absent in the imago (or at most vestigial).

In Telephoridae (fig. 1, A) the venter remains as soft as the dorsum, only the centre of each half ring being slightly hardened; sternum II is quite free like the others and plainly visible behind the hind coxa; there is no connation whatever.

In Staphylinidae (fig. 1, B) the sterna are sclerotised as in the families here following, except the intersegmental membranes, which are concealed in the non-extended abdomen; sternum II is very small, connate with III but free at its upper end, all the other sterna being free.

The Cerambycidae (fig. 1, C), and a large number of other families the sterna of which are usually described as free, have II and III connate, II being concealed by the large hind coxa and reduced in size, In practically all the Curculionidae (fig. 2, D) and other Rhynchophora with the exception of Anthribidae and Attelabinae, II, III and IV are connate, II being concealed.

The *Adephaga* (fig. 2, E) inclusive of Gyrinidae and Rhysodidae are distinguished, apparently from all other Coleoptera, by sternum II being large and plainly visible above the small hind coxa; II, III and IV are firmly connate and the others free.

Connation has advanced a step farther in Tenebrionidae (fig. 2, F), II to V being united.

In most Anthribidae (fig. 3, G) and the Attelabinae, and likewise in many Lamellicornia, II to VI are connate.

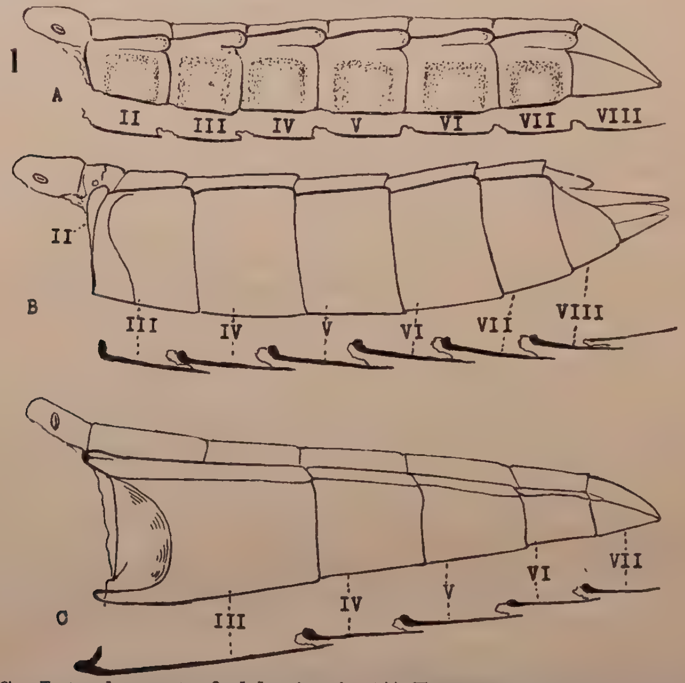

Fig. 1, A–C.—Lateral aspect of abdomina in (A) Telephoridae, sternum II free; (B) Staphylinidae, sternum II very small, connate with III but free at upper end; (C) Cerambycidae, sterna II and III connate, II being concealed by hind coxa and reduced in size.

And, finally, in some Anthribidae and some Lamellicornia (fig. 3, H) all the sterna have lost their freedom.

The diagrams of the longitudinal sections speak for themselves; I draw special attention, however, to fig. 2, F, because there the connate segments show very distinctly that they were originally free like the posterior segments. There are two sections of the venter of *Scarabaeus* (fig. 3, H); the lower one represents the median section, which shows slight traces of the ancestral segmentation; the upper section is taken half-way up the side where the ridge between the last two segments is very high (for the accommodation of muscles), the entire last (VIIIth) sternum remaining connate.

Sketches A to H are selected illustrations of the main steps of development from the entirely free venter to the entirely connate one, and do not imply that we know the true range of variation in the families mentioned.

In my undergraduate days it would have been quite in accord with the then prevailing views on evolution to regard connation as a process which had the object to strengthen the venter for the better protection of the viscera. Great sclerotisation as such, however, does not lead to connation, nor are connate segments always strongly sclerotised. In the Longicorns with hard venter, e.g. *Lamia textor*, *Dorcadion* and the South African *Phrissoma* and allies, the hard sterna have preserved their mobility, and in the South African Curculionid genus *Brachycerus*, perhaps the hardest of all beetles, only the anterior sterna are connate and the posterior ones free as usual in CURCULIONIDAE. On the other hand, the venter of many small Lamellicorns, though connate, is moderately sclerotised and flexible.

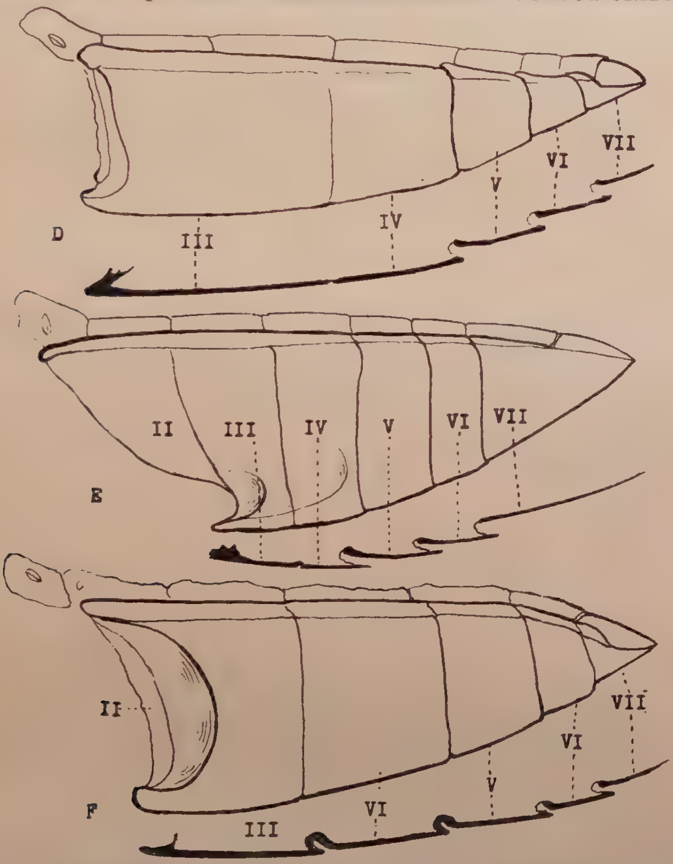

FIG. 2, D–F.—Lateral aspect of abdomina in (D) CURCULIONIDAE and other Rhynchophora with exception of ANTHRIBIDAE and ATTELABINAE, sterna II, III, IV are connate, II being concealed; (E) *Adephaga*, sternum II large; II, III, IV firmly connate. (F) TENEBRIONIDAE, sterna II to V united.

Whether two, three or more sterna are connate may appear to some scientists of taxonomic interest only, and of little importance in general biology. That view, however, would be very superficial. On the contrary, every distinction discovered in systematics is the result of development, and therefore has a history in the life of the individual and a history in the evolution of the particular species, and of the higher category to which the species belongs. Thus considered, any systematic distinction may transcend the field of systematics.

Connation is a case in point. It is a development superimposed on the normal segmentation. There are two main phases in the ontogenesis of connation: (1) the formation, in the pupa, of the abdominal segments of the imago, the skeleton consisting in the early stages of pale soft chitin, and (2) the hardening of the chitin in later stages by the infiltration of sclerotine. As in some families the intersegmental membranes are present between all segments, whereas in others some or all of these membranes disappear, or are hardened, it is evident that the process of sclerotisation is controlled. We know nothing about this controlling factor; but we may reasonably assume that there is a predisposition in the chitin stage of the venter which determines the distribution of the sclerotine. Nor do we know whether the sterna which are connate in the mature insect are telescoped, *i.e.* free, in the early stages of development in all or some families; whether the process of connation commences in the individual at the anterior segment and is gradually continued from segment to segment; or whether membranes are present in the early stages of connate segments in some families and not in others; and so on. The investigator of these questions would encounter another problem intimately connected with connation. Straus-Durckheim (1828) discovered that the longitudinal muscles, which bend the venter down by their contraction, were absent from the connate sterna, and he drew the conclusion that the disappearance of the musculature was the result of the immobility of the connate segments. Connation thus

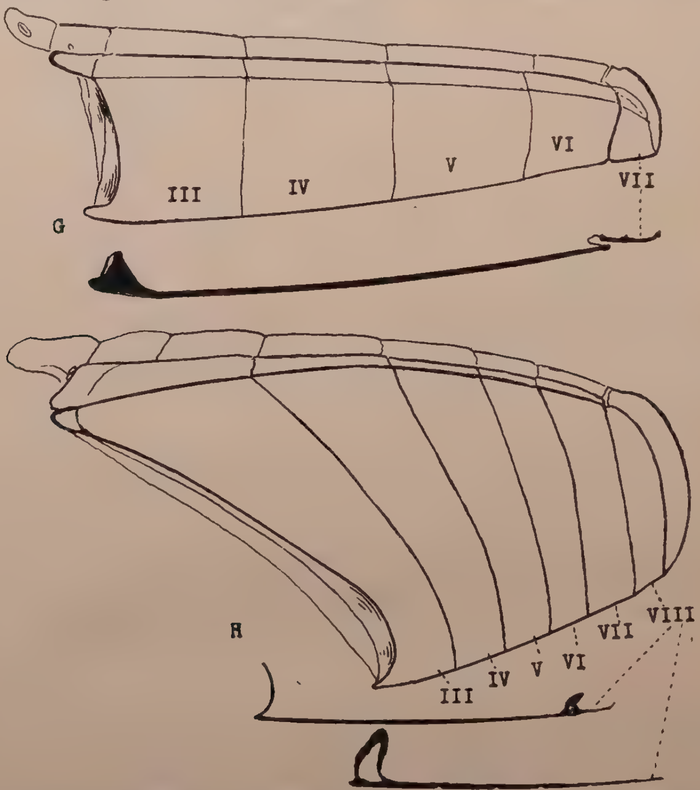

Fig. 3, G–H.—Lateral aspect of abdomina in (G) most ANTHRIBIDAE, ATTELABINAE, and many Lamellicornia, sterna II–VI connate; (H) in some ANTHRIBIDAE and Lamellicornia all the sterna have lost their freedom.

plunges us right into the old controversy about the effect of use and disuse on the evolution of an organ. It would be interesting to know whether connation has been mentioned in any of the numerous books on evolution; I have not found a reference to it. As connation is fluctuating in some families, an extensive investigation will probably bring to light cases in which the disappearance of the muscles is in an intermediate stage. Such links in evolution would be most instructive.

The abdomen of *Geotrupes* suggests a modification of the cause of the reduction of the muscles. It is small and entirely covered by the elytra except ventrally; the telescoping movement of the sterna is restricted (the abdomen is generally described as free) and the easy downward movement of the whole abdomen is due to its loose connection with the thorax. The abdomen contrasts strongly with that of *Scarabaeus* (= *Ateuchus*) and *Melolontha*, and would be worth studying in connection with other *Coprophaga*.

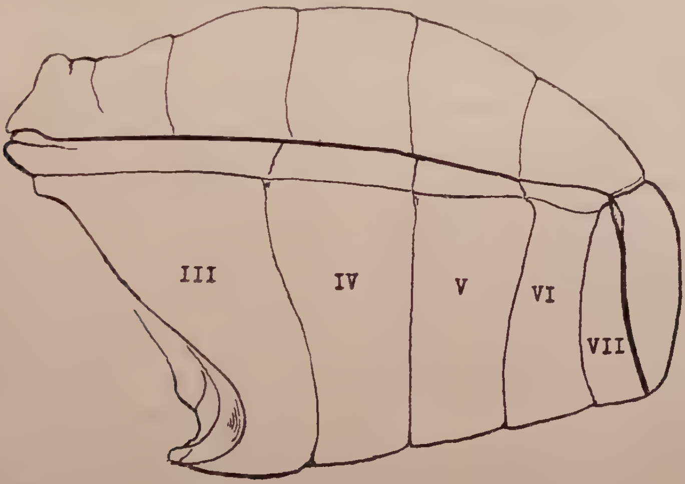

FIG. 4.—Lateral aspect of abdomen in ATTELABINAE.

As we have seen from figs. 1–3, A–H, the lowest degree of connation is found at the thoracic end of the venter.[1] It is interesting to note that Kolbe (1893 : 309) looked upon the fusion of the abdominal segments as a continuation of the process of solidification of the thorax. It is indeed possible that we meet here with a kind of metamerism, the stimulus to connation being introduced from the thorax into the abdomen. However that may be, the evidence derived from morphology leaves little doubt that at least in one superfamily, the *Rhynchophora*, connation began at the base of the abdomen, the following table strongly supporting Kolbe's view that the number of connate sterna increased gradually from the anterior end. Variation as shown in the table may occur in other superfamilies or within a family (for instance *Lamellicornia*) : that is a matter for further research.

The connate sterna are :—(1) II & III in a few CURCULIONIDAE (Marshall) and in PLATYPODIDAE. (2) II to IV in the bulk of the CURCULIONIDAE, the BRENTHIDAE and SCOLYTIDAE. (3) II to V not known. (4) II to VI in the ATTELABINAE and most ANTHRIBIDAE. (5) II to VII in some ANTHRIBIDAE.

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[1] In *Clythra* and closely allied CHRYSOMELIDAE the last two sterna are connate, the preceding ones free; this kind of connation is outside the scope of the paper

There is a gap in the series, the third step not having been discovered as yet. The number of genera not examined as to connation being very large, the missing link may be found some day. The two most advanced steps are connected by intergradations, VII being often connate with VI at the sides and free in the middle. The table evidently presents a case of Orthogenesis, with a very definite stoppage of the process of connation behind sternum IV in the very large majority of the *Rhynchophora.* This control broke in the ATTELABINAE and ANTHRIBIDAE, and connation advanced in most of the genera to the end of VI and in others included also VII, a remarkable contrast with the huge mass of CURCULIONIDAE.

The ATTELABINAE are distinguished by another abdominal character from all the other *Rhynchophora* (as far as studied) inclusive of the ANTHRIBIDAE. While in most Coleoptera protected by hard elytra the dorsum of the abdomen is more or less soft, only the posterior terga being hard as far as exposed, the terga of the Attelabines are firm and connate, only the last tergum, the pygidium, being free. The dorsum is a convex roof which does not collapse after death (fig. 4). The Attelabine abdomen is a box closed by the movable pygidium as a lid. The lower margin of the aperture is formed by sternum VII; but this half ring is so short that its movement downwards adds very little to the size of the aperture and nothing at all in species where VII is medianly more or less connate with VI. The movability of the lid depends on the flexibility of the small membranes between the lid and tergum VI and sternum VII. As the innate trend or urge to connation, or whatever name we may employ for the causal force in this process of evolution, has been able to break the barrier at the end of IV, restrict the mobility of VII and solidify terga I to VI, it is not likely that the activity of this force has been or will be definitely stopped at the base of sternum VII and the pygidium. However, if the connection of the pygidium either with tergum VI or sternum VII became inflexible, there would be no opening for the gut and sexual organs. Individuals thus affected would leave no offspring, and the result would be the ultimate extinction of the species if there were no check on the final step in connation. The process itself exercises a check on excess, at least to some extent. No two individuals being alike, we may assume that the inherent trend to connation varies individually in the degree of its driving power. Specimens in which the power is greatest will have a closed abdomen and will have no offspring, and their trend to excessive connation will be eliminated. Extremes produced by the mating of individuals near the borderline will always be cut off. An accumulation of the trend to excessive connation is thereby at least diminished, and the species survives. But insects depend for their survival largely on their great fertility. The destruction here assumed to go on among ATTELABINAE in consequence of excessive connation would be a handicap which might become disastrous in adverse environmental conditions. That something of the kind has happened is suggested by their statistics. Like the Anthribids the ATTELABINAE are an ancient branch of the *Rhynchophora*; they are widely distributed in both hemispheres, but there is no more than a mere sprinkling of species anywhere. In spite of the great morphological distinctness of many species and in spite of the frequency of bright red colour which should give them some protection against insectivorous birds and mammals, the number of existing species is quite small, perhaps exceeding 400 by little. Such a small figure, quite diminutive as compared with the tens of thousands of other CURCULIONIDAE, is significant and suggests that the recent ATTELABINAE are a remnant of a formerly more numerous group of beetles.

Much has been written about the causes of the extinction of the antediluvian monsters, and in the absence of factual evidence imagination has had to come to the rescue. The little ATTELABINAE, some of which resemble saurian monsters in the excessively long neck, present us with a better case; for the living beetles allow us to collect evidence for the support of the suggestion here advanced. The beetle emerging from the pupa with the back-door closed would not die immediately after having attained maturity, sufficient energy being left over from early stages of the insect to carry the imago along for some time. If such specimens exist, they can be found. We have two ATTELABINAE in Great Britain, *Apoderus coryli* and *Attelabus nitens*. In collecting them they offer a chance to observe evolution in action. Why not take it?

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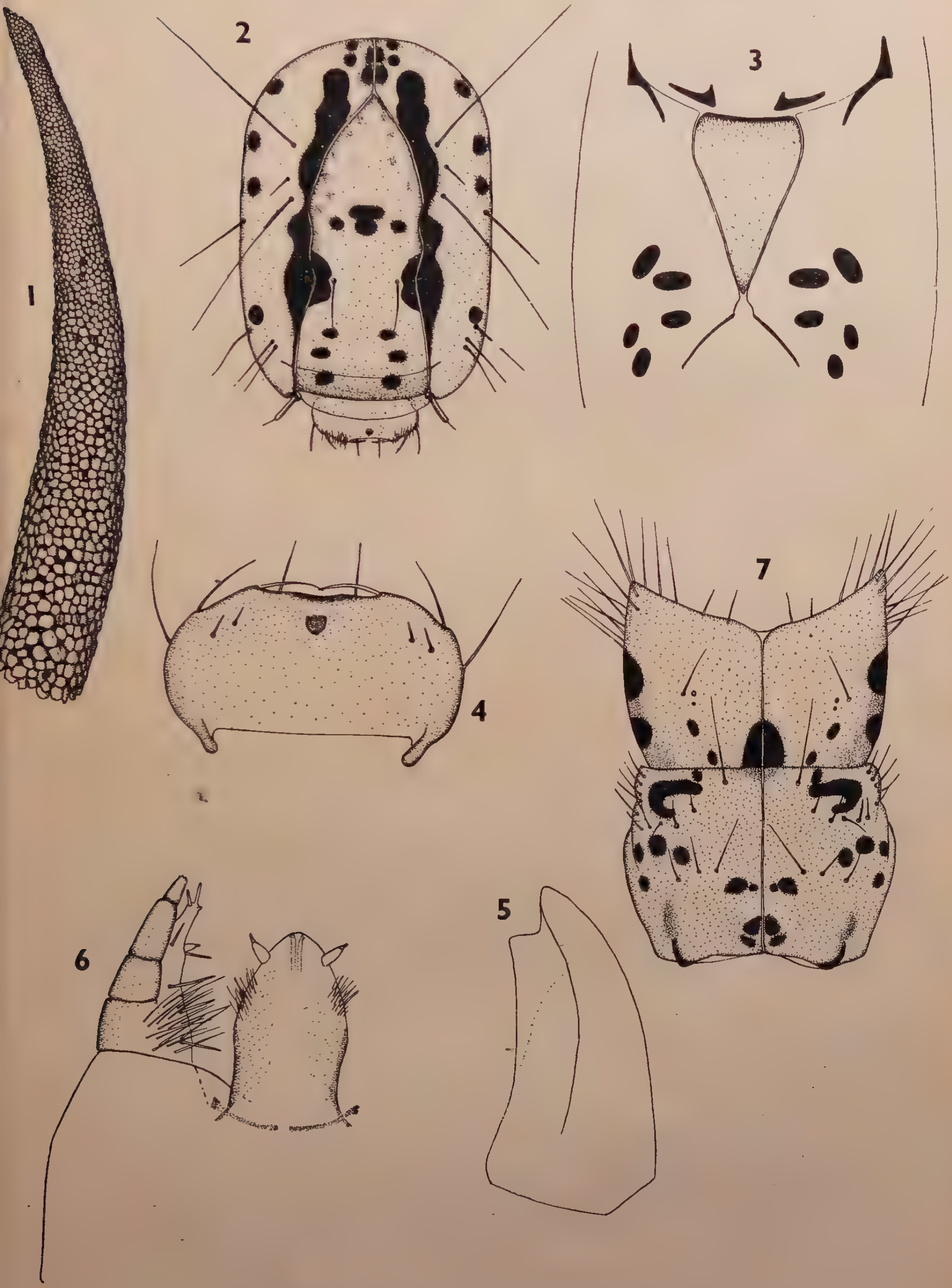
LARVAE OF THE BRITISH TRICHOPTERA. 18

By N. E. Hickin, Ph.D., F.R.E.S.

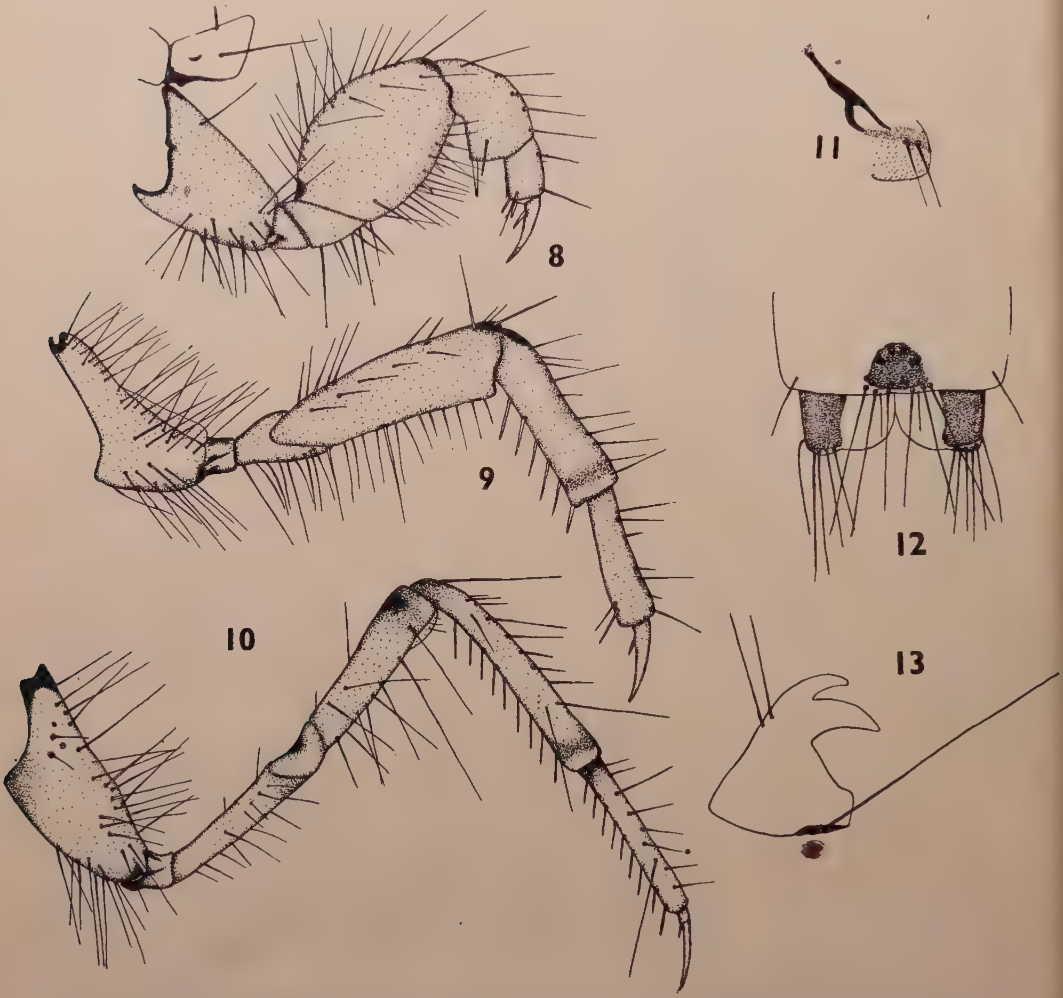
Leptocerus aterrimus Steph. (Leptoceridae).

A large number of larvae were collected at King's Heath, Birmingham, several of which, on being reared to the adult stage, were determined as *Leptocerus aterrimus* Steph. The larvae were dragging their cases over the gravelly bottom at the sides of the canal. In this still water there is present a fair amount of aquatic and marginal vegetation.

Case. Sand grains cemented together with secretion, curved and tapering posteriorly. Opening at posterior end oblique. Length and width at posterior end varies within fairly wide limits as, in many cases, the older (posterior) end of the case breaks off. Length up to 18 mm.; width at anterior end up to 3 mm. *Larva.* Eruciform with abdomen uniformly cylindrical. Length 11 mm., width 2 mm. *Head.* Orthocentrous, elliptical, about one and a half times as long as wide, with outer edges of genae parallel. Light yellowish-brown with heavy black markings. Clypeus large and divided into a wide transverse oral part and a narrow longitudinal aboral part not strongly marked. Clypeus mark consists of four black spots at aboral end, two arranged in the median line longitudinally (represented by Esben-Petersen by four smaller spots), with one mark on each side. At oral end three pairs of spots arranged transversely. At the narrowest part of the clypeus is a pair of black marks. Genae marked with a sinuous black band running on each side of the clypeus and tapering towards the oral end, with several black marks at the side and a group near the vertex of the clypeus. Gular sclerite tapers acutely aborally. Antennae two-segmented, distal segment long and provided with an apical bristle. Labrum notched at points where marginal bristles arise. A small dark greyish-brown mark occupies a median position near the anterior margin. Right mandible with three teeth, left mandible with two. Maxillary palp four-segmented, exactly same length as maxillary lobe (to tip of large sense organs). Base of maxillary lobe provided with long bristles, a few of which are fairly stout. Labium with tuft of fine hairs on each side near the base of the labial palps. Lateral margins of labium sclerotised at the base. *Thorax.* Prosternal horn absent. Only pro- and mesonota sclerotised, but sclerotisation extends over pleural region in prothorax only. Pro- and mesonota with median longitudinal sutures and approximately equal in width. A pair of black marks on each side of the pronotum laterally and a single median mark on the posterior margin, divided by the median suture. A pair of smaller black marks on each side of the posterior half of the notum. Mesonotum slightly darker in colour and with black marks arranged in three groups. A pair of hook-shaped marks anteriorly (sometimes made up of small separate spots), a series arranged in a transverse concave band and four black marks in the median line near the posterior margin. *Legs.* Prothoracic legs short and broad, held bunched up at the sides of the head. A free plate-like sclerite arises from the coxa pleurite. It is provided with two bristles. Mesothoracic leg long with about six evenly spaced spines on ventral edge of the tibia. Metathoracic leg longer than mesothoracic. Dark marks at the extremities of the segments of the leg give a banded appearance. Femur partially divided at the proximal end. *Abdomen.* Uniformly cylindrical. Creamy-white in colour. Lateral and median dorsal protuberances on first abdominal segment. Lateral protuberances are partially sclerotised, provided with a few bristles and further supported by a spur-shaped black sclerite (just visible to the naked eye). Gills are present only on the first three abdominal segments and on the first of these there is no dorsal series. The gills consist of small tufts of filaments united to a



FIGS. 1–7.—1, Case. 2, head. 3, gular sclerite. 4, labrum. 5, mandible. 6, maxilla and labium. 7, pro- and mesonota.



Figs. 8–13.—8, Prothoracic leg. 9, mesothoracic leg. 10, metathoracic leg. 11, lateral protuberance on first abdominal segment. 12, last abdominal segment. 13, anal claw.

common base or stalk. Anal sclerite with four darker marks at anterior margin and with several long bristles near the posterior margin. Anal claws short and broad with two hooks.

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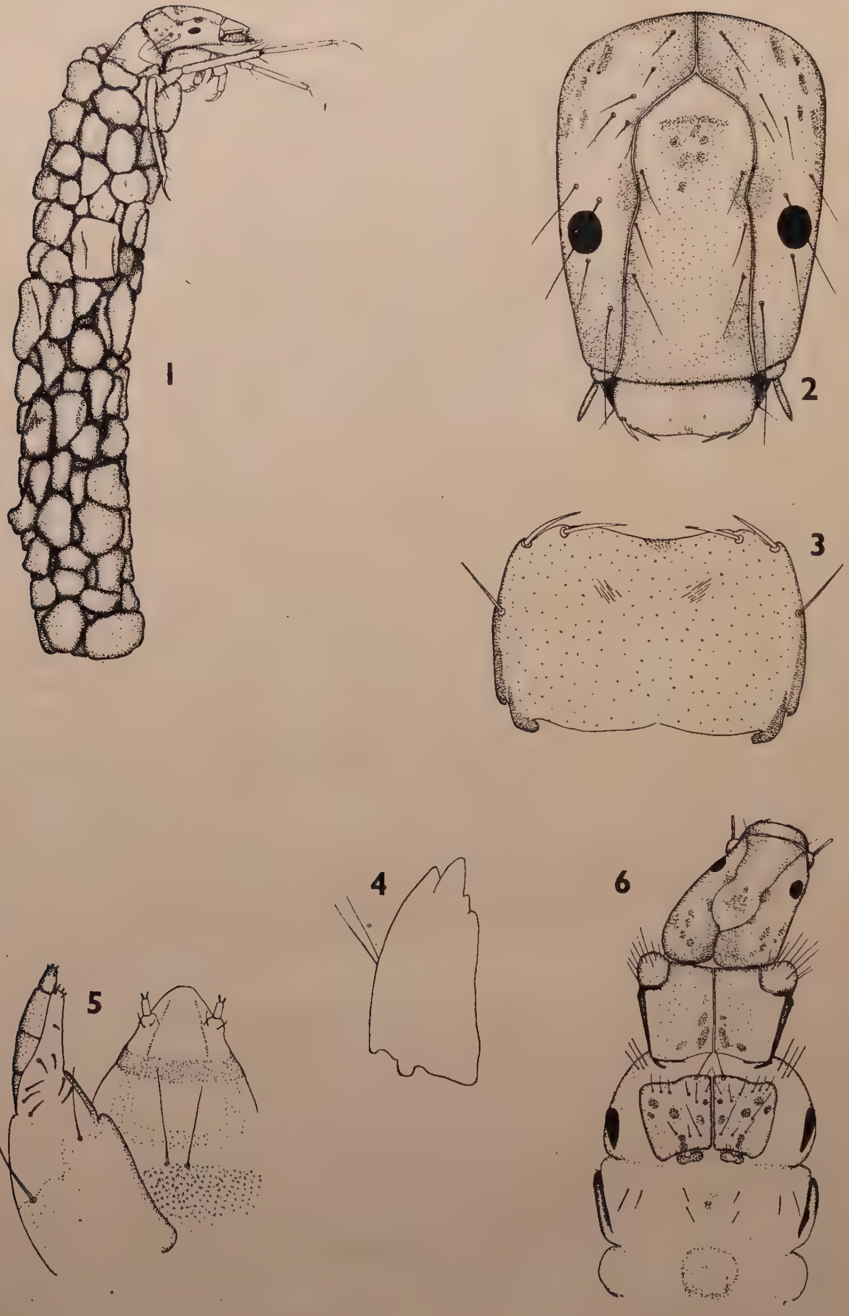
LARVAE OF THE BRITISH TRICHOPTERA. 19

By N. E. Hickin, Ph.D., F.R.E.S.

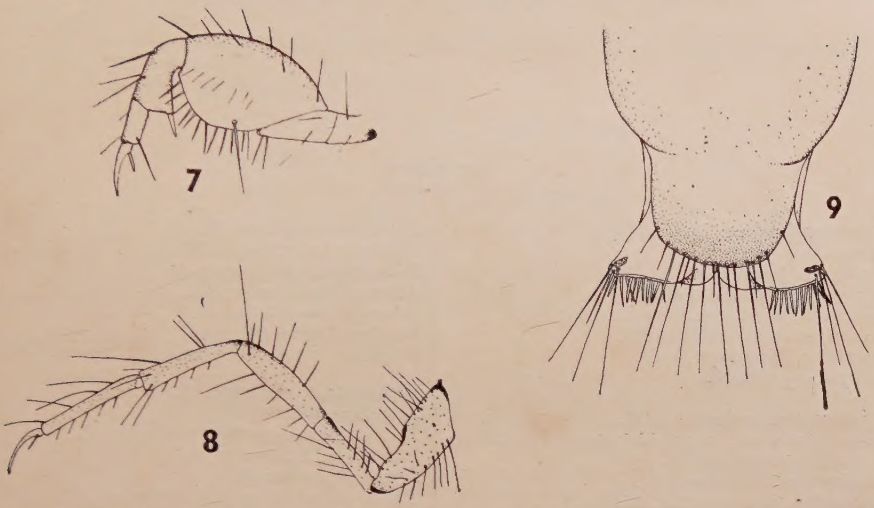
Setodes argentipunctella McLachlan (Leptoceridae).

Material for this description was very kindly given by Dr. T. T. Macan of the British Freshwater Biological Association's Laboratories at Wray Castle. The larvae were collected round the shore of Lake Windermere, south of Watbarrow Point on the 13th July 1937, and a few subsequently reared to maturity were identified by Mr. M. E. Mosely as belonging to this species. It inhabits the littoral region of Lake Windermere and some of the neighbouring lakes and tarns. Ulmer and Rousseau give rapid mountain streams as its habitat.

Case. Slightly curved, of sand grains and small stone chippings and flakes cemented together. Length 7 mm., width 1·5 mm. *Larva.* Eruciform. Length 6 mm., width 0·9 mm. *Head.* Not strongly orthocentrous, long, with sides tapering towards oral end, yellowish shading to brown. Oral part of clypeus long; sutures very distinct, showing as a yellow line, indentations not deep. Aboral end of clypeus almost spherical, clypeus mark in aboral part of clypeus consists of a transverse band overlying a few irregularly placed spots. A dark mark at each side of the clypeus extending into the genae at the indentation and others also about half-way between the latter and the apex of the clypeus. Antennae with bulbous proximal segment and comparatively long filiform distal segment. *Mouthparts.* Labrum with two pairs of inwardly directed light yellow spines on the anterior margin and with a bristle on each lateral margin. More heavily sclerotised on the lateral margins and curving inwards posteriorly and terminating in a short, rounded projection. Mandibles 4–5 toothed with two bristles on outside edge. Maxillary palp four-segmented, maxillary lobe long and slender, almost as long as the palp, and with a few claw-like spines at the base. Tips of palp and lobe provided with sense organs. Labium with a transverse sclerotised bar curving posteriorly on the ventral surface. Base of labium spinulose with two long bristles. *Thorax.* Pronotum sclerotised with a median longitudinal suture and two lateral sutures cutting off the anterior angles. Each angle provided with hairs. Two or three dark marks along each side of the median suture, lateral margin heavily sclerotised, black in colour. Mesonotum sclerotised, consisting of two almost rectangular plates (divided by a median suture) with two transverse rows of bristles and one transverse row of dark spots concave anteriorly and a larger spot situated in the middle of each sclerite near the posterior margin. In the concavity of the posterior margin is a pair of dark marks (sometimes confluent) on each side with a few very small hairs. Coxa pleurites of meso- and metathorax black, heavily sclerotised. Metanotum unsclerotised but with a faint dark mark in the centre. *Legs.* Prothoracic legs very short and broad, usually held bunched up under the head. Tibia with an angle projecting ventrally and provided with a small spine. Meso- and metathoracic legs long and thin with a few hairs but not constituting a "swimming fringe." Metathoracic legs slightly longer than the mesothoracic. *Abdomen.* Long, greyish-white to yellow (with a reddish tinge in some specimens) tapering distally. Slight lateral and dorsal protuberances on the first segment. Last segment much narrower than the preceding with a number of long bristles along the posterior margin. Anal claws represented only by a small sclerite at the tip of the anal lobe, apparently completely embedded. Four or five large bristles near each sclerite and a number of yellow spines (about fifteen) along the posterior margin of the lobe.



Figs. 1–6.—1, Larva in case. 2, head. 3, labrum. 4, mandible. 5, maxilla and labium. 6, head, thoracic segments and first abdominal segment.



Figs. 7–9.—7, Prothoracic leg. 8, metathoracic leg. 9, anal segments.

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